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## Inflation, Real Interest Tax Wedges, and Capital Formation

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This paper focuses on how inflation interacts with taxes and interest rates to affect capital formation.<sup>1</sup> It uses a simple credit-market framework to explain how inflation magnifies the distorting effects of taxation when the tax treatment of interest income and expense is not fully indexed to inflation.<sup>2</sup> The distortion involves a real tax wedge consisting of the difference between the real interest rate fully taxed investors must pay when they borrow to invest and the real after-tax interest rate that savers earn. This asymmetry in the way that fully taxed investors and savers are affected by income taxes leads to an increase in inflation increasing the real tax wedge in credit markets.

Either eliminating inflation or indexing the tax treatment of interest income and deductible interest expense to inflation would reduce this real tax wedge and consequently increase private saving and business capital formation. Eliminating inflation or its induced tax effects on interest rates would decrease nominal rates for two reasons: Absent inflation, interest rates would not contain an inflation premium; hence, nominal interest rates would be lower. Furthermore, if there were no inflation, or if the tax treatment of interest income and deductible interest expense were indexed, nominal interest rates would fall because saving as a function of the interest rate would tend to increase.

With the higher after-tax returns that would result from removing the tax on the inflation premium in nominal interest rates, savers would save more. An increased supply of saving would in turn lower before-tax real interest rates and thereby stimulate the business investment.

Not everyone would benefit from eliminating the inflation-induced tax distortion in credit markets, however. Although eliminating inflation or indexing the taxes on interest income and expense would raise private saving and nonresidential investment, governments and homeowners would face higher real borrowing costs and real interest outlays. This would happen because after-tax real interest rates are not only the effective real rates that savers earn; they are also the effective real rates at which the government and homeowners borrow. Fully taxed borrowers borrow at a before-tax real interest rate, but the government borrows at an after-tax real rate because its interest payments to the public add to the income on which it collects taxes. Homeowners also borrow at an after-tax real rate. They are not taxed on the real benefits from living in their homes, which are effectively income, and in the United States, unlike some other countries, their related interest costs can generally be deducted from taxable income.

In summary, either eliminating inflation or indexing the tax treatment of interest income and expense to inflation would stimulate private saving and, in turn, business investment, but it would decrease tax receipts on interest income and the tax deductions that subsidize home ownership.

### INFLATION AND THE TAX WEDGE

Stiglitz (1973) and Auerbach (1983), among others, have shown that the investment decisions of fully taxed investors are motivated by before-tax, not after-tax, real interest rates. It is intuitively reasonable to specify that investment decisions depend

<sup>1</sup> The theoretical basis for the present article is derived from Dewald (1986).

<sup>2</sup> There have been many detailed studies of taxes that have taken interactions with inflation into account. See, for example, Feldstein and Summers (1979), Fullerton and Karayannis (1993), and King and Fullerton (1984).

on real returns and real interest rates, and thus are not influenced by inflation. Investors presumably cut through the veil of inflation to make decisions based on real fundamentals. However, it is counterintuitive to specify that investment decisions depend on before-tax, not after-tax, real interest rates. After all, taxes are certainly an important cost factor for businesses. Nevertheless, there is a good argument for why borrower-financed investment would not be directly affected by a uniform tax rate that applied to both investment income and the deductions for interest expense. Suppose the cost of an investment is  $c$ , the expected return in one period is  $1 + g$ , and the interest cost in one period is  $1 + i$ . The investor would continue to invest as long as net profit  $a$  was not negative:  $a = (1 + g) - c(1 + i)$ . The investment decision would not be affected by changes in the income tax rate,  $\tau$ , since the appropriate choice to maximize  $(1 - \tau)a$  would also maximize  $a$ . Hence, for fully taxed investors facing the same tax rate on their earnings and their deductible costs, the before-tax interest rate,  $i$ , influences investment decisions, not the after-tax interest rate,  $i(1 - \tau)$ .

The argument is that investors would rank alternative investments on the basis of the expected profitability of each investment, net of interest and other costs. A change in the tax rate would change the expected profitability associated with alternative investments, but it would not change the ranking of their expected profitability. The investment that was ranked as the most profitable when the tax rate was 50 percent would still be the most profitable when the tax rate was reduced to 40 percent. On the basis of this argument, investment decisions are specified to depend on before-tax interest rates, which would affect the ranking of investment alternatives with respect to expected profitability.

To restate this critical argument: Prospective investors who finance their investments by borrowing would make the same rankings of the expected profitability of particular investment alternatives regardless of the level of tax rates. Profits, of course, would differ with different tax rates, but as

long as the same tax rate were applicable to both investment returns and deductible interest expenses, the level of tax rates would not influence the rank order of the profitability of investment alternatives.<sup>3</sup> An implication is that prospective before-tax real rates of return on investments and prospective before-tax real rates of interest at which such returns are discounted would affect investment decisions, not after-tax rates of return or after-tax rates of interest. Thus, tax rates would not influence investment choices *directly*.

Tax rates, however, would influence investment choices *indirectly* because tax rates would affect saving and, indirectly, the market-clearing real interest rates at which investment is financed. Increasing inflation and/or tax rates would lower savers' after-tax interest-rate earnings and thus decrease saving, thereby raising before-tax real interest rates and reducing investment. These points are clarified by reference to the following figures. A numerical example appears on p. 34.

In Figure 1, real investment by fully taxed borrowers varies inversely with a before-tax real interest rate:  $r^B = i - \pi$ , where  $i$  is the nominal interest rate and  $\pi$  is the inflation rate. Real saving,  $S$ , in contrast to real investment, is specified to vary directly with an after-tax real interest rate:  $r^L = i(1 - \tau) - \pi$ . When both the tax rate,  $\tau$ , and the inflation rate,  $\pi$ , are zero, the real rate for borrowers,  $r_0^B$ , equals the real rate for lenders,  $r_0^L$ . The upward-sloping saving function intersects with the downward-sloping investment function at point A to determine the equilibrium market interest rate,  $r_0^B$  and saving (= investment),  $S_0$ .

As noted, enactment of a tax on interest income leaves the investment function unaffected. But, as depicted in Figure 2, the upward-sloping saving function depends on the after-tax real interest rate. The saving function rotates up and to the left with an increase in the tax rate from zero to  $\tau_1$ . As a result, the credit-market equilibrium would shift from A to B, the equilibrium real rate for borrowers would increase from  $r_0^B$  to  $r_1^B$ , the equilibrium real rate for savers would decrease from

<sup>3</sup> In the U.S. economy, applicable tax rates differ. Fazzari and Herzon (1996) identify how different tax rates may affect investment decisions.

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Figure 1

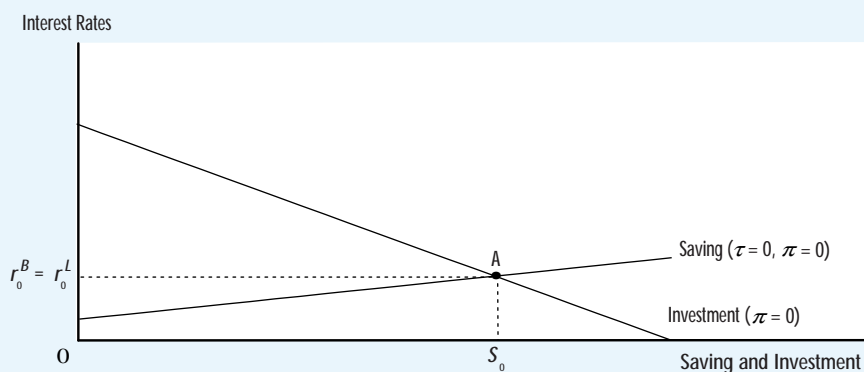


Figure 2

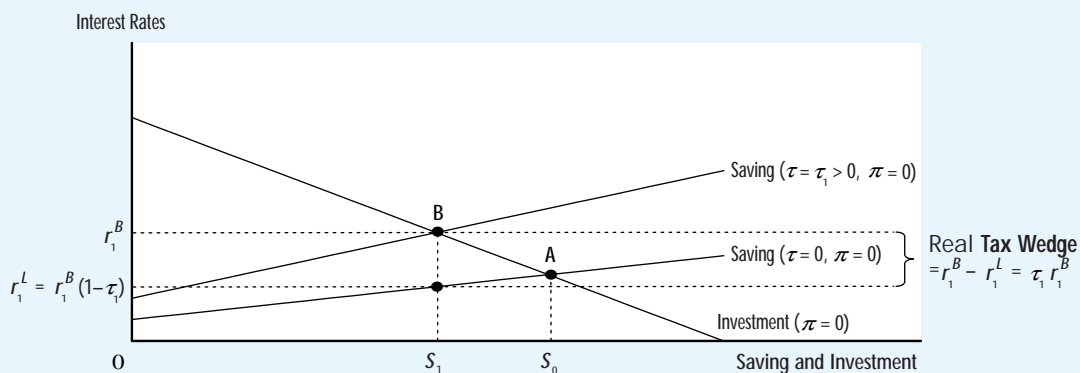
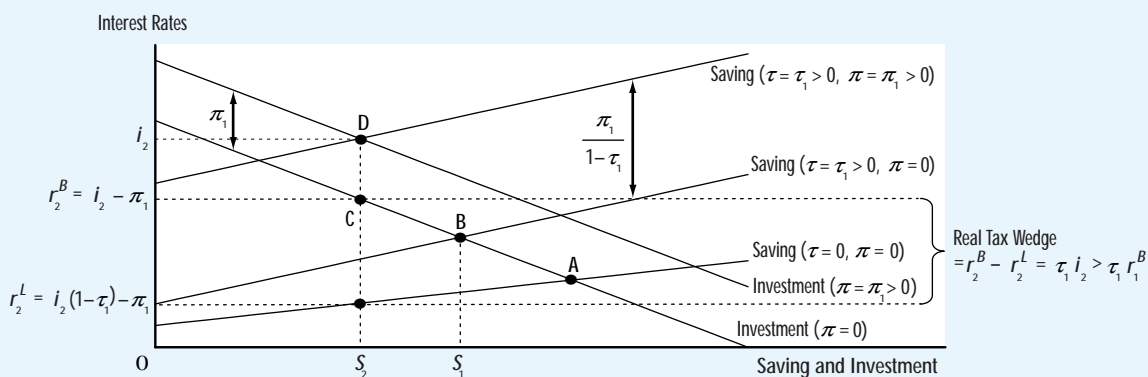


Figure 3



$r_0^L$  to  $r_1^L$ , and the equilibrium level of saving would decrease from  $S_0$  to  $S_1$ . The difference between  $r_1^B$  and  $r_1^L$  represents a real tax wedge, essentially reflecting that the difference between the borrowing rate

and lending rate on such credit-market transactions is transferred to the government in taxes.

Figure 3 illustrates what happens when there are both inflation and income

taxation. As noted above, rankings of alternative investments are independent of both the tax rate and inflation. Consequently, real investment, as a function of the *nominal* interest rate, shifts up by exactly the increase in the inflation rate,  $\pi_1$ . In contrast, when savers are taxed on their interest income, the saving function must rise by more than the increase in the inflation rate. As shown in Figure 3, to get the same saving when inflation increases to  $\pi_1$  with tax rate,  $\tau_1$ , the nominal interest rate would have to increase by  $\pi_1 / (1 - \tau_1)$ . That is an amount such that  $(1 - \tau_1)$  of it is equal to the increase in inflation. Thus, an increase in inflation shifts the saving function up by  $\pi_1 / (1 - \tau_1)$ , which, given that the tax rate is positive but less than one, is greater than the upward shift in the investment function, which shifts up by  $\pi_1$ . Consequently, an inflation increase from zero to  $\pi_1$  would move the credit-market equilibrium from  $B$  to  $C$  in real terms. The nominal interest rate is determined by the equilibrium point,  $D$ , which is at the intersection of real saving and real investment specified as functions of the *nominal* interest rate. The result is a higher market-clearing nominal interest rate,  $i_2$ , and a higher before-tax real interest rate,  $r_2^B$ , but a *lower* after-tax real interest rate,  $r_2^L$ , and *lower* level of saving,  $S_2$ . Expressed another way, an increase in inflation from zero to  $\pi_1$  would increase the real tax wedge.

The effect of inflation on real interest rates is really the crux of the credit-market distortion associated with the interaction of inflation, taxes, and interest rates. The distortion causes a change in the allocation of resources from what it would be in an inflation-free environment.

It can be shown that if interest income and expense are not indexed to inflation in the tax structure, the *real* tax wedge equals the tax rate times the *nominal* interest rate.

Note that

- with zero inflation, the real tax wedge is  $r_1^B - r_1^L = \tau_1 r_1^B$ , but
- with inflation  $\pi_1$ , the real tax wedge is

$$r_2^B - r_2^L = (i_2 - \pi_1) - [i_2(1 - \tau_1) - \pi_1] = \tau_1 i_2.$$

Thus, when inflation increases from zero to  $\pi_1$ , the real tax wedge increases by

$$\tau_1(i_2 - r_1^B) = \tau_1[(r_2^B + \pi_1) - r_1^B].$$

The inflation-induced increase in the real tax wedge incorporates three elements: the tax rate,  $\tau_1$ , the increase in the inflation rate,  $\pi_1$ , and the inflation-induced increase in the before-tax real interest rate,  $r_2^B - r_1^B$ .

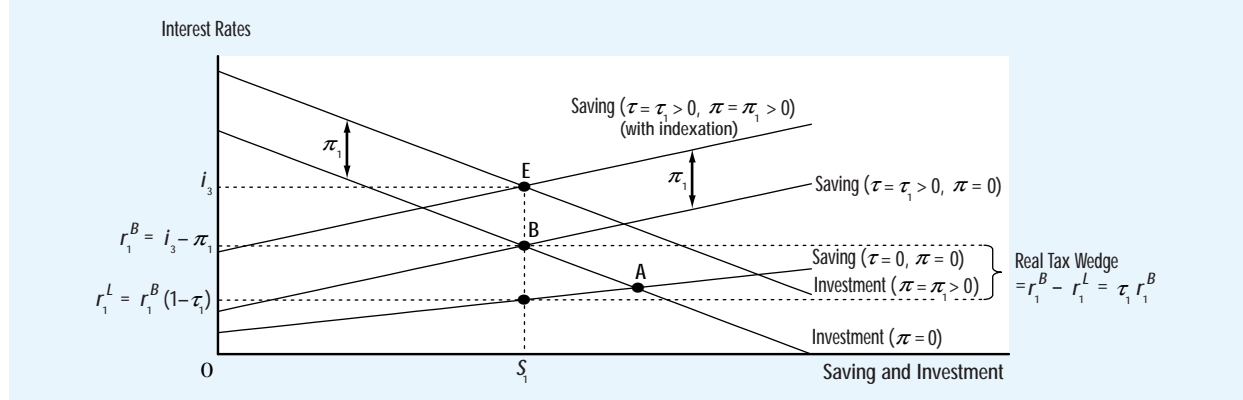
The incidence of inflation-induced tax increases would depend on the investment and saving function elasticities. If saving were perfectly inelastic with respect to interest rates, the full incidence would fall on saving. If investment were perfectly inelastic with respect to interest rates, the full incidence would fall on investment. Since empirical studies tend to confirm that saving is comparatively inelastic, it is reasonable to conclude that much of the impact of an increase in inflation on taxes would fall on savers, although any induced reduction in saving would be reflected in reduced capital formation.

To reiterate the argument in Figure 3, increased inflation would effectively raise the tax on savers' interest income and lower their real after-tax interest earnings. In response, they would plan to save and lend less, which would raise the real interest rate on borrowing to finance investment. Either an increase in inflation or an increase in tax rates would increase the real tax wedge; that is, it would increase the before-tax real rate that influences investors but decrease the after-tax real rate that influences savers. Since an inflation increase would shift the saving function back and thereby induce a decrease in investment, it has the same qualitative effect in reducing capital formation as an increase in tax rates.

## INDEXING THE TAX TREATMENT OF INTEREST INCOME

Figure 4 shows that the benefits of eliminating inflation on capital formation

Figure 4



can be obtained by indexing the tax treatment of interest income and expense to inflation. Saving is now specified to depend on an after-tax real interest rate where the tax is based on a before-tax real interest rate—not, as previously, on a before-tax nominal interest rate. Consequently, both the investment function and the saving function are now specified to be independent of the inflation rate. Both functions shift up by exactly the increase in inflation. Under indexing, for any inflation rate, there would be a lower-equilibrium nominal interest rate and a lower before-tax real rate but a higher after-tax real rate for savers. The real tax wedge would not be eliminated, but it would be made independent of inflation. The equilibrium nominal before-tax interest rate would be  $i_3$ , the before-tax real rate would be  $r_1^B$ , the real after-tax rate would be  $r_1^L = r_1^B(1 - \tau_1)$ , and the real tax wedge would be  $\tau_1 r_1^B$ . Other than the nominal interest rate, which would fully reflect inflation, the real before-tax and after-tax interest rates and real saving and investment would be precisely the same under indexing as if inflation were eliminated.

## POLICY IMPLICATIONS

The roughly 3 percent inflation rate over recent years is low compared with inflation in the late 1970s and early 1980s. But 3 percent is not zero. As the

numerical example in the shaded insert shows, even 3 percent inflation could be linked to a substantial real tax wedge.

Eliminating inflation remains a putative goal of monetary policy. If inflation is not eradicated completely, it is reasonable to consider designing tax policies to avoid real distortions in the allocation of resources that result from the interaction of inflation, interest rates, and taxes. Indexing income tax rates to inflation, but not the tax treatment of nominal interest income and expense, leaves the interest-sensitive capital-formation process subject to potentially significant distortions. Although inflation-indexed Treasury bonds were introduced in 1997 to index nominal interest returns to inflation, these nominal returns continue to be taxed as ordinary income. Therefore, simply indexing interest rates to inflation does not index the tax treatment of interest income and expense to inflation and thus does not fully protect the credit market from distortions that accompany increases in inflation.

Effectively indexing the tax treatment of interest income and expense would prevent inflation from arbitrarily raising tax rates on saving and reducing corporate investment as it did in the 1970s and early 1980s.<sup>4</sup> For whatever technical or political reasons, indexing the tax treatment of interest income and expense is difficult to

<sup>4</sup> Fazzari and Herzon (1996) show how indexing capital gains taxation for inflation would increase incentives to invest, but they may not recognize that even if capital gains are indexed for inflation, the taxation of nominal interest income would lower real rates to savers but raise real rates to borrowers thus raising the cost of capital, thereby decreasing incentives to invest.

## SOME EFFECTS OF INFLATION ON TAX WEDGES AND CAPITAL FORMATION: AN EXAMPLE

A numerical example further illustrates the argument in this article. The example is based on a simple linear credit market-model with taxes and inflation. Units of saving and investment are in billions of dollars.

### Numerical Example

Saving (no indexing):

$$S = -10 + 1000[i(1 - \tau) - \pi].$$

Saving (indexing):

$$S = -10 + 1000[(i - \pi)(1 - \tau)].$$

Investment:

$$I = 90 - 1000[i - \pi].$$

Equilibrium:

$$S = I.$$

In the no-indexing case, saving is a function of an after-tax interest rate,  $r^L = i(1 - \tau) - \pi$ . Taxes paid by savers depend on the nominal interest rate,  $i$ . If, by assumption, the tax rate is 40 percent and the inflation rate is 3 percent, the nominal interest rate is 10 percent. Savers earn a 6 percent after-tax nominal interest rate, i.e.,  $[10 \text{ percent} \times (1 - 0.4)]$ . Their after-tax real rate of return is 3 percent, i.e.,  $[10 \text{ percent} \times (1 - 0.4) - 3 \text{ percent}]$ . The before-tax real interest rate influencing investors is 7 percent, i.e.,  $(10 \text{ percent} - 3 \text{ percent})$ . The difference between before-tax and after-tax real interest rates is 4 percent, which is the 40 percent tax on the 10 percent nominal interest rate. This 4 percentage point difference is the real tax wedge. It would be associated with real saving and investment of \$20 billion.

If inflation were eliminated altogether, there would still be a real tax wedge, but it would be reduced by the magnitude of the tax on the decrease in the interest rate on which savers are taxed. Compared with the 3 percent inflation case, eliminating inflation would reduce the real before-tax interest rates from 7 percent to 6.25 percent but raise the real after-tax interest rate from 3 percent to 3.75 percent, thus decreasing the real tax wedge from 4 percent to 2.5 percent, thereby inducing an increase in saving from \$20 billion to \$27.5 billion.

Fully indexing the tax treatment of interest income for savers would make saving a function of an after-tax rate that is independent of inflation:  $r^L = (i - \pi)(1 - \tau)$ . Taxes paid by savers depend on the real interest rate,  $(i - \pi)$ , and not the nominal interest rate,  $i$ . Even with 3 percent inflation, but with the introduction of indexing, the nominal interest rate would fall from 10 percent to 9.25 percent, the real before-tax interest rate would fall from 7 percent to 6.25 percent, the real after-tax interest rate would rise from 3 percent to 3.75 percent, the real tax wedge would fall from 4 percent to 2.5 percent, and saving (= investment) would rise from \$20 billion to \$27.5 billion. These are precisely the same real magnitudes that would result from eliminating inflation.

If taxes were also eliminated, the real interest rate that clears the credit market in this example would be 5 percent, the real tax wedge would be zero, and saving (= investment) would be an undistorted \$40 billion.

implement. Consequently, price-level stability becomes all the more important a monetary policy objective, the achievement of which would reduce distortions in credit markets that retard saving, investment, and capital formation.

### A FEDERAL BUDGET DEFICIT COROLLARY

The corollary is that real taxes would tend to fall and real federal budget deficits would tend to rise when inflation declines or interest income and expense are



indexed to inflation. By contrast, a conventional view is that indexing the taxes on interest income and expense to inflation would lower nominal interest rates and thus decrease the government deficit.<sup>5</sup> The argument is that, "... even if the fall in the nominal rate [because of indexing] was only 1 percentage point (a figure that can be considered conservative), it would still have important effects. It would, for example, by reducing interest costs in the public debt, reduce the U.S. fiscal deficit by \$8 billion . . . ."<sup>6</sup> Such an argument is questionable. It does not take into account that the government borrows at an effective after-tax real interest rate because it collects taxes on the interest it pays to taxpayers.

The present argument has shown that indexing the taxes on interest income and expense or reducing inflation would increase, not decrease, after-tax real interest rates and thus increase the effective real interest rates at which the government borrows. In its simplest terms, the argument is that indexing interest taxation to inflation would eliminate one source of federal revenue—the tax on the inflation premium in nominal interest rates. Consequently, indexing interest taxation or eliminating inflation would increase, not decrease, the real federal budget deficit. The fallacy in the argument that indexing interest taxation to inflation would decrease the deficit is in not taking into account that indexing would tend to raise the effective real interest rate on government borrowing and hence raise the real budget deficit.

## CONCLUSION

Either lowering inflation or indexing the taxation of interest income and expense would reduce real taxes and stimulate saving and nonresidential investment by eliminating a major distortion that influences capital formation and potential growth. Absent an effective program to index interest income and expense to inflation, keeping inflation low and, in principle, eliminating it represents an effective way to

minimize the real tax wedge between the real rates that influence investors and savers, thereby stimulating capital formation. The bottom line is that price stabilization policies are pro-growth policies.

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<sup>5</sup> See Makin (1985) and the record of comments by Feldstein in Aaron (1976), page 80.

<sup>6</sup> Tanzi (1984).